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Applicant : SHINETSU ENG KK

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Inventor :

SEKIKAWA TOSHIO

KASUYA KAZUMI

KATAGIRI KIYOO

LAMINATING DEVICE FOR GLASS SUBSTRATE FOR LIQUID CRYSTAL DISPLAY BOARD

[Abstract]

PURPOSE: To provide the laminating device which can execute lamination having a degree of parallelisum of high accuracy by eliminating the influence exerted by variances even if there are the variances in a degree of flatness of the upper surface plate and the lower surface plate for laminating glass substrates for a liquid crystal display board and a degree of parallelisum at the time of assembling them, and also, a degree of parallelisum in the glass substrates.

CONSTITUTION: In the laminating device for glass substrates, in which a fixed baseplate 2 is provided on the lower side of a machine frame 1, a movable

baseplate 3 is attached to the upper part of its fixed baseplate 2 so that its vertical motion is executed freely, and also, the lower surface plate 4, and the upper surface plate 5 are attached so as to be movable in the horizontal direction, on the fixed baseplate 2 and under the movable baseplate 3, respectively, the upper surface plate 5 is constituted of a fixed outer frame 9 and a movable surface plate part 10 positioned in the outer frame 9, its movable surface plate part 10 is connected to the fixed outer frame 9 by a connecting member 12 having rigidity in the plane direction, and having flexibility in the vertical direction, a pressure means 13 is provided in plural parts in the periphery of the movable surface plate part 10, and also, detecting means 14, 15 for detecting a gap between glass substrates (a), (b) in its pressure part are provided, and pressure force of the pressure means 13 is controlled by a detected value of its detecting means.

[Claims]

1. A laminating device of glass substrates for a liquid crystal display panel in which a fixed base plate is provided on a lower portion of a machine frame, a movable base plate is installed at an upper portion of the fixed base plate to be movable freely in a longitudinal direction, and a lower surface plate and an upper surface plate are attached on the fixed base plate and under the movable base plate, respectively, so as to be movable in a horizontal direction, wherein the upper surface plate includes a fixed outer frame and a movable surface plate part positioned in the outer frame, the movable surface plate part is connected to the fixed outer frame by a connecting member having rigidity in a horizontal direction and flexibility in a vertical direction, a pressurizing unit is provided in plural parts in the circumference of the movable surface plate part, a detecting unit for detecting a gap between glass substrates is provided at the pressurized portion, and the pressurizing unit is controlled by a detected value of the detecting unit.

[Title of the Invention]

LAMINATING DEVICE FOR GLASS SUBSTRATE FOR LIQUID CRYSTAL DISPLAY BOARD

[Detailed Description of the Invention]

[Field of the Invention]

The present invention is related to a laminating device of glass substrates (upper and lower electrode substrates) configuring a liquid crystal display panel, and more particularly, to a laminating device having improved parallelism of an inner side surface of a bonded glass substrate.

[Description of the Prior Art]

In a liquid crystal display (LCD) panel, a liquid crystal is sealed in an inner side of a sealant using spacers of several μm between two glass substrates on which a transparent conductive electrode is coated and thus the two glass substrates are bonded without misalignment by an aligning mark. Fig. 6 shows a conventional laminating device performing a bonding of two glass substrates. As shown in the drawing, a lower surface plate 16 made of a metal plane plate and an upper surface plate 18 are installed to be movable at a fixed base plate 17 and a movable base plate 19, respectively, in a longitudinal direction. The movable base plate 19 lowers to pressurize two glass substrates (a) and (b). A sealant (c) between the two substrates (a) and (b) are pressurized until forming a particular thickness, thereby partitioning a space for sealing a liquid crystal.

The pressurization is performed by pressing the sealant having about 30μ before the pressurization into 6 to 8μ and making a gap between inner side

surfaces of the glass substrates uniform to thereby increase parallelism.

[Problems to be Solved by the Invention]

In order to provide a parallelism of the inner side surfaces of the glass substrates by the conventional laminating device under a condition of a level of ± 0.1μ, two methods are provided, namely, (1) one method for increasing parallelism when upper and lower surface plates are assembled with base plates by increasing flatness of the upper and lower surface plates (i.e., the flatness of face of each surface plate), and (2) the other method for improving the parallelism of glass substrates (i.e., indeed, corresponding to 15 to 20μ).

However, the satisfactory parallelism may be difficult to be obtained using the two methods. As a result, the gap between two glass substrates completely bonded with each other may not be uniform, and thus a color stain may occur in the liquid crystal display panel having completely formed. Furthermore, in the one method (1), in order to reduce influence by misalignment of the upper and lower surface plates and ununiformity at the time of bonding with each other, a buffer such as a rubber sheet is inserted between the surface plate and the glass substrate. However, it is also difficult to obtain the satisfactory parallelism.

Thus, to solve the aforementioned problems of the prior art, the present invention provides a laminating device capable of performing the bonding process having parallelism with high accuracy without any influence by ununiformities in flatness of the upper and lower surface plates, parallelism at the time of bonding with each other, and parallelism of glass substrates.

[Means for Solving the Problem]

To achieve the above object of the present invention, there is provided a laminating device of glass substrates in which a fixed base plate is provided on a lower portion of a machine frame, a movable base plate is installed at an upper portion of the fixed base plate to be movable freely in a longitudinal direction, and a lower surface plate and an upper surface plate are attached on the fixed base plate and under the movable base plate, respectively, so as to be movable in a horizontal direction, wherein the upper surface plate includes a fixed outer frame and a movable surface plate part 10 positioned in the outer frame, the movable surface plate part is connected to the fixed outer frame by a connecting member having rigidity in a horizontal direction and flexibility in a vertical direction, a pressurizing unit is provided in plural parts in the circumference of the movable surface plate part, a detecting unit for detecting a gap between glass substrates is provided at the pressurized portion, and the pressurizing unit is controlled by a detected value of the detecting unit.

The connecting member for connecting the movable surface plate part with the fixed outer frame can be positioned anywhere of on an upper surface of the movable surface plate part, in the middle portion of a thickness direction of the movable surface plate part, on a lower surface of the movable surface plate part, and the like. The connecting member can be formed of spring steel, or other flexible materials.

Furthermore, as the detecting unit for detecting the gap between the glass substrates, a load cell for detecting a varied degree (ununiform degree) of a gap between the pressurized glass substrates in upper and lower directions, and a gap meter for detecting the gap between the two glass substrates by directly monitoring from its lateral direction.

[Operation]

According to those units, the upper surface plate includes the fixed outer frame and the movable surface plate part. The movable surface plate part is connected to the fixed outer frame by the connecting member having rigidity in its horizontal direction and flexibility in its vertical direction. Accordingly, when the movable surface plate part lowers by operating the pressurizing unit positioned in the plurality parts of the movable surface plate part, the lowered degree is different according to a pressurizing force of the pressurizing unit. As a result, a variation of the ununiform degree of the pressurized portion is monitored, or the pressurizing force of the pressurizing unit is controlled by feedbacking the detected value of the gap meter, so as to obtain uniformity of the gap (parallelism) between the two glass substrates.

[Embodiment of the Invention]

Hereinafter, explanations will be provided for embodiments of the present invention with reference to the drawings. A boding apparatus A includes a machine frame 1, a fixed base plate 2 fixed to an inner lower portion of the machine frame 1, and a movable base plate 3 arranged at an upper side of the fixed base plate 2. A lower surface plate 4 for supporting a lower glass substrate (a) is provided on the fixed base plate 2, and an upper surface plate 5 for absorbing and maintaining an upper glass substrate (b) is provided under the movable base plate 3.

The lower surface plate 4 positioned on the fixed base plate 2 includes a lower member 6 sliding on the fixed base plate 2 in a Y-direction, and an upper member 7 provided on the lower member 6, for rotating horizontally. The lower

member 6 is supported to be slidable by two guiding arms fixed on the fixed base plate 2 in an upright state, the guiding arms being positioned between the lower member 6 and the fixed base plate 2. The upper member 7 is rotatably supported by the lower member 6 in a state that bearings 8 are interposed between the lower and upper base plates 6 and 7.

The upper surface plate 5 supported below the movable base plate 3 includes an annular fixed outer frame 9 with a square plane surface, and a movable base plate part 10 of a flat plate shape positioned in an inner side of the fixed outer frame 9. The fixed outer frame 9 is coupled to a guide rail 11 fixed to the machine frame 1 to be movable in an X-direction. The movable base plate part 10 is provided in the fixed outer frame 9 in a horizontal direction. The fixed outer frame 9 and the movable base plate part 10 are connected in their four edges using a connecting member 12 formed of spring steel having rigidity in its horizontal direction and flexibility in its vertical direction.

The connecting member 12 is fixed on the surface of the fixed outer frame 9 and the upper surface of the movable base plate part 10. Each pressurizing unit 13 is fixed on a nearly central portion of the circumference of the movable base plate part 10 where the connecting member 12 is connected. A displacement gauge 14 such as a load cell for detecting a varied degree (ununiform degree) of a gap between two pressurized glass substrates in upper and lower directions is provided at each portion where the pressurizing unit is installed. Accordingly, the pressurizing force is controlled by feedbacking a detected value of the displacement gauge 14 to the pressurizing unit.

Figs. 4 and 5 show embodiments of the apparatus for detecting an interval between inner surfaces of two glass substrates (a) and (b) and performing their

bonding. Gap meters 15 for monitoring the interval between the inner surfaces of the two glass substrates (a) and (b) are fixed to the machine frame 1 to surround the glass substrates (a) and (b). Each gap meter 15 feedbacks its detected value to the pressurizing unit and thus the pressurizing force of each pressurized unit with respect to the movable base plate part 10 is controlled. In addition, as shown in Figs. 4 and 5, the gap meter 15 is constructed as same as aforementioned in the embodiment so that an explanation of its construction is omitted. A continuous hole to which a vacuum suction force is applied is formed in a surface at which the upper surface plate 5 is contact with the upper glass substrate (b) of the movable base plate part 10 is applied thereto. The continuous hole is connected to a vacuum pump and thus an absorption force for absorbing the glass substrate (b) on the movable base plate part 10.

When two glass substrates are bonded using the laminating device having explained, if the movable base plate part 10 is pressurized downwardly by the pressurizing unit 13, the movable base plate part 10 connected to the fixed outer frame 9 by the connecting member 9 having flexibility in its vertical direction is pressurized by the pressurizing force of each pressurizing unit 13. As a result, the glass substrates (a) and (b) are bonded by the pressurizing force which is not uniformly applied on the entire surfaces thereof, so as to be ununiformly bonded according to the strength of the pressurizing force. Therefore, the pressurizing force of each pressurizing unit 13 is detected by the displacement gauge 14, to control the pressurizing force of the pressurizing unit 13 on the basis of the detected value, so that the gap (parallelism) between inner surfaces of the two glass substrates (a) and (b) can be uniform.

Furthermore, in the laminating device shown in Figs. 4 and 5, the gap

between the two glass substrates (a) and (b) to be bonded is monitored and detected by the gap meter 15 arranged at the outer circumference of the glass substrates (a) and (b). The strength of the pressurizing force of the pressurizing unit 13 in the corresponding portion is adjusted according to the detected value. Hence, the gap (parallelism) between the inner surfaces of the two glass substrates (a) and (b) to be bonded can be uniform.

[Effect of the Invention]

As described so far, in the laminating device according to the present invention, the upper surface plate includes the fixed outer frame and the movable base plate part positioned in the fixed outer frame, and the movable base plate part is connected to the fixed outer frame by the connecting member having rigidity in its horizontal direction and flexibility in its vertical direction. The pressurizing unit is installed in plural positions in the circumference of the movable base plate part, a detecting unit for detecting the gap between glass substrates is installed in the pressurized portions by the pressurizing units, and accordingly the pressurizing unit is controlled by the detected value obtained by the detecting unit. Hence, the strength of the pressurized force in the circumference of the movable base plate part, by which the glass substrates are bonded with each other, can be adjusted. Therefore, even if there are ununiformities in flatness of the surfaces of upper and lower surface plates, flatness when assembling the surface plates, and parallelism of the glass substrates, the gap (parallelism) between the inner surfaces of the glass substrates can be uniform, free from the influence by the ununiformities.

[Brief Description for the Drawing]

Fig. 1 is a longitudinal sectional view showing an embodiment of the laminating device according to the present invention.

Fig. 2 is a horizontal sectional view taken along the line (2)-(2) of Fig. 1.

Fig. 3 is a longitudinal sectional view showing the state that a movable base plate part is pressurized by a pressurizing unit.

Fig. 4 is a longitudinal sectional view showing another embodiment of the laminating device according to the present invention.

Fig. 5 is a horizontal sectional view taken along the line (5)-(5) of Fig. 4.

Fig. 6 is a longitudinal sectional view showing the conventional laminating device.

[Explanation for Reference Symbol]

A-laminating device, 1-machine frame, 2-fixed base plate, 3-movable base plate, 4-lower surface plate, 5-upper surface plate, 9-fixed outer frame, 10-movable base plate part, 12-connecting member, 13-pressurizing unit, 14-detecting unit (displacement gauge, gap meter), a, b- glass substrate